

NCR 399



The NCR 399 can be equipped to read high-density magnetic-stripe ledger cards and to feed two continuous forms under independent program control.

MANAGEMENT SUMMARY

With the introduction of the 399 Accounting Computer System on March 10, 1972, NCR has significantly impacted the marketing plans of many of its small accounting computer competitors. (A comprehensive survey of these competitive systems can be found in DATAPRO 70 Feature Report 70F-420-01). For the first time, a major mainframe vendor has combined all the right elements required to support small general business and accounting applications: a flexible, low-priced, minicomputer-based system with full accounting features, a variety of peripheral devices including integrated cassette drives, and remote communications capability.

The NCR 399 is built around a new 16-bit minicomputer, the NCR 605, that is tied in to an integrated magnetic tape cassette handler, a serial (ball) printer, separate alphanumeric and 10-key numeric keyboards, and basic forms handling facilities. Optional peripherals include an additional cassette handler, a removable magnetic disk capability, punched card and paper tape devices, and a medium-speed line printer, as well as a variety of magnetic ledger card and other forms control devices and communications interfaces. Most of the features of the 399 can be installed or removed at the customer's site, allowing relatively painless modification of the originally installed configuration.

The NCR 399 is the first of a family of systems based on a 16-bit NCR minicomputer. As a small stand-alone accounting computer, the 399 neatly "bridges the gap" between electronic accounting machines and full-fledged computers. It can also operate as an intelligent or programmable remote terminal via communications adapters.

CHARACTERISTICS

MANUFACTURER: The National Cash Register Company, Dayton, Ohio 45409.

MODEL: NCR 399 Accounting Computer System.

DATA FORMATS

BASIC UNIT: 16-bit word at machine level. Each word can represent two 8-bit alphanumeric characters or bytes, or four 4-bit numeric digits.

FIXED-POINT OPERANDS: Can range from 1 to 256 8-bit alphanumeric bytes or 1 to 16 4-bit numeric digits in length at the user (macro-instruction) level.

FLOATING-POINT OPERANDS: No provisions for floating-point arithmetic are provided.

INSTRUCTIONS: 1, 2, or 3 operands at the user (macro-instruction) level, with an optional action code and an N-field code to specify the length of a byte string or field length, etc., for variable-length operands.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: Magnetic core.

CAPACITY: 8,192 to 16,384 bytes in increments of 2,048 bytes.

CYCLE TIME: 1.2 microseconds per 2-byte (16-bit word) access.

CHECKING: Parity bit with each word is generated during writing and checked during reading.

STORAGE PROTECTION: Individual memory locations cannot be protected from read or write access by application programs, although the Interpreter restricts user programs from developing reference addresses that would interfere with the integrity of the 399 control programs.

CENTRAL PROCESSOR

INDEX REGISTERS: None for use at the macro instruction level by programmer. Sixteen 16-bit registers are provided at the machine level for use in instruction execution, program control, and I/O control.

INDIRECT ADDRESSING: None.

NCR 399

➤ The NCR 399 is directed at first-time accounting computer users as well as the upper end of NCR's installed customer base of about 100,000 accounting machines of all types. Initial customer deliveries of the 399 are scheduled for the fourth quarter of 1972—nearly two years after first shipment of its IBM System/3 Model 6 counterpart and almost five years after initial delivery of the latest previous NCR accounting computer (the NCR 400 in 1967). Thus, the long-promised 399 system finally offers a cost-effective upgrade alternative to users of the NCR 395, 400, and 500 systems. The cost/performance benefits exhibited by these older NCR machines when they were first introduced have long since required shoring up through price cuts by NCR to prevent erosion under the steady attack of a host of other accounting computer systems from more than a dozen other vendors. At a basic system price tag of \$14,000, the NCR 399 offers computational capabilities similar to those of the basic IBM System/3 Model 6 at less than one-third of the purchase price. The 399 also compares favorably with the much lower-priced accounting computers from other manufacturers, thus strongly re-establishing NCR as a major source of supply for small accounting computer buyers.

A flexible communications capability, allowing connection to other NCR 399's or to larger processors such as the NCR Century Series or the IBM System/360 or 370, gives the NCR 399 full-fledged status as an intelligent or programmable remote terminal as well as a small stand-alone computer. A determination of the effectiveness of the 399 system when operated as a remote batch terminal must be withheld until detailed specifications on the disk, line printer, punched card, and paper tape peripherals are released later this year, as promised by NCR at the time of the 399 announcement.

The programming language for the NCR 399 is a version of NEAT/3—a macro-level assembly language that is also available for the larger NCR Century Series computers. A user can enter source code through the NCR 399 console for local assembly; or he can prepare his programs on a Century computer and deliver them to the 399 on a cassette.

Although compatibility for a subset of the NEAT/3 programming language is provided between the NCR 399 and the larger Century series computers, a number of differences in the ledger card capabilities of the 399 and earlier NCR accounting machines will generally require a media conversion process to transfer a magnetic ledger workload to the 399. NCR support facilities are provided to assist in this conversion, and NCR should be contacted for further details.

Because the major marketing targets of the NCR 399 are small accounting and general business applications, many of the NCR 399 customers will not be large enough to ➤

➤ **INSTRUCTION REPERTOIRE:** 64 basic machine operation codes are provided in the processor. These hardware instructions are accessed through 37 NCR 399 commands that are implemented in the software Interpreter program provided by NCR. The NCR 399 command repertoire consists of 13 arithmetic commands, 9 data transfer commands, 8 logical testing and branch commands, and 7 I/O and control commands. No floating-point commands are provided.

INSTRUCTION TIMES: All times given below are for Interpreter commands at the user level, and are in milliseconds. Note that the NCR 399 commands are ordinarily macros, and require the execution of a subroutine.

Fixed-point add/subtract	
1-digit fields:	1.5 msec.
8-digit fields:	1.8
16-digit fields:	2.3
Fixed-point multiply/divide	
1-digit fields:	7.9/16.0
8-digit fields:	18.9/29.2
16-digit fields:	35.2/44.9
Branch (unconditional);	0.3
Test and branch	
1-digit numeric field:	1.3
8-digit numeric field:	1.5
16-digit numeric field:	1.8
1 to 256 alphabetic character(s):	1.1 to 66.3
Indicator	0.3 to 0.8

INTERRUPTS: A demand interrupt capability is provided to permit processor overlap of buffered operations on the integrated and free-standing peripherals as well as communications message handling. Each of the eight common ports to memory has an interrupt with a fixed priority established by the relative position of that port's attachment to the memory bus. Port 1 has the highest priority and is normally used for attachment of the communications adapters, when present.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The NCR 399 has a Common Port multiplexer capability with eight ports that can each attach up to 8 devices for a total of 64 paths to memory. The common ports are standard and provide the means for communication between the processor and the following integrated peripherals and processor features; Alpha-numeric, 10-key, or Full Accounting Keyboards; magnetic ledger; Automatic Line Find (ALF); Continuous Forms Feeders (CFF); basic forms handler; Magnetic Ledger Feeder/Reader; serial (ball) printer; the cassette(s); and the NCR 399 communication capability.

An optional common trunk is available for selector attachment of free-standing NCR 399 peripherals except the Magnetic Ledger Card Feeder/Reader and the disk unit. The common trunk provides asynchronous communication through the common port between the processor and the card reader, card punch, paper tape reader/punch, and line printer. Data is transferred over the common trunk in 8-bit byte parallel fashion at up to 20,000 bytes per second. All data transfer is in ASCII mode. The common trunk is field-installable.

➤ **A Direct Memory Access (DMA) data transfer mode is provided for the removable disk storage device.** ➤

NCR 399



When equipped with a synchronous or asynchronous communications adapter, the NCR 399 serves as an intelligent terminal that can handle editing, formatting, validating, and batching of input data for transmission to a remote computer.

- ▷ support an in-house programming staff. For these customers, NCR is assembling a library of commercially used application packages that can be modified by NCR to fit individual customer specifications. This programming service will be performed by NCR for an individually negotiated flat fee. The ready-to-run programs will be delivered to customers on a turnkey basis.

Extensive human-factors considerations have been engineered into the NCR 399 to promote operator acceptance of the system. A variety of field-alterable keyboard layouts is available, with audible tones sounded as each key on the 10-key pad is depressed for data entry; and a number of control buttons, system status indicators, etc., are provided to simplify the operator interface. The physical arrangement of the NCR 399 provides a wide workspace with comfortable access to the keyboards; this effectively reduces operator strain and eliminates the cramped impression given by many other accounting consoles.

Among the other features of the NCR 399 are:

- Increased magnetic-stripe ledger card capacity, with up to 782 alphanumeric characters (or 1564 numeric digits) per side—more than four times greater capacity than that of previous NCR accounting computers and greater than that currently offered by any other vendor.
- Unusually flexible roll, cut-form, and continuous-forms handling capabilities, which are fully alterable in the field.

- ▷ **SIMULTANEOUS OPERATIONS:** Only one device at a time can transfer data over the common trunk, but simultaneous operation of the common trunk with integrated peripherals or the DMA peripherals is possible at an aggregate data rate up to the memory bus bandwidth, which is over 315,000 cycles/second. Numeric keyboard operations, the serial printer, communications send/receive, forms and platen control, paper tape rewind, card reading/punching, and cassette rewind can all be initiated during processing and any one can take place simultaneously with computing through a memory “cycle-stealing” technique.

MASS STORAGE

A removable disk storage device is promised for the NCR 399, with detailed specifications to be released later in 1972. No further information about the disk unit is available at this time.

INPUT-OUTPUT UNITS

MAGNETIC TAPE CASSETTE HANDLERS: Two magnetic tape cassette drives are available for the NCR 399. Both are used for reading and/or writing programs and user data. Cassette 2 is optional. Program loading takes place from Cassette 1 only. A sliding work shelf covers the cassette handlers and a spare cassette storage area on the NCR 399 console. Data is recorded on the Philips-type cassettes at a density of 800 bits per inch in serial fashion, providing up to 100 8-bit ASCII characters per inch. The cassettes use an inter-record gap of 0.8 inch, and can provide storage for nearly 170,000 bytes of unblocked, 80-column card-image records on one track of a cassette nominally containing 300 feet of tape (about 282 feet is usable for data recording with the rest used for leader, etc.). The forward tape speed is 7.5 inches per second, yielding a data transfer rate (in the forward direction only) of 6000 bits/sec or 750 bytes/sec. Typical load time for a 16K-byte program is about 27 seconds. A read-after-write check is provided for each cassette handler.

When a photoelectric cell senses the end-of-tape (EOT) marker, a flag is set that can be used by the program to initiate automatic rewind, with a rewind speed of about 50 inches/second. By reversing the cassette, data can be recorded on a second track on the tape, thus doubling the effective storage capacity of each cassette. Special keyboard control buttons allow manual retry and recovery in case of a tape error. NCR 399 tape cassettes are available through the Systemedia Division of NCR or from independent vendors.

OPERATOR CONSOLE: Contains the numeric and alphanumeric keyboards, the system control keys, system status indicators, basic forms handler, serial printer, and magnetic tape cassette handler 1. The console also houses the central processor and provides space for the attachment of the following optional “integrated” peripherals: Automatic Line Find (ALF), magnetic ledger, 1 or 2 continuous forms feeders, a right-rear eject with receiving tray, cassette handler 2, and the communications adapter. All of these options are field-installable.

The basic forms handler provides for manual front insertion and alignment of cut forms such as ledgers and invoices, and rear insertion of journal sheets, journal rolls, and tally rolls. The standard platen on the basic forms handler is split (left 9 inches, right 13.1 inches), and can independently position forms on either the left or right side; or the two

NCR 399

➤ Thus, the NCR 399—as a stand-alone accounting computer or an intelligent remote terminal used for data entry and/or remote batch processing—offers a rich menu of processing modes for business computing. Customized turnkey software from NCR, plus a worldwide support organization with more than 25,000 field engineers and technical support personnel operating from more than 1400 sales and service offices, hold forth more than an empty promise of system support for NCR's traditional financial and retail industry customers. Among the other industry targets for the NCR 399 are the manufacturing and construction trades, as well as motor freight carriers at the truck terminal level, remote I/O stations for medical institutions, and wholesale applications including inventory control and credit checking. Many of the applications in these industry areas require direct access to good-sized data bases as well as at least medium-speed I/O devices. Thus, details of the promised disk unit and other peripheral equipment will be anxiously awaited.

Upon delivery of the turnkey software packages and appropriate peripheral devices having specifications comparable in quality to the basic system, the 399—with its NCR nameplate and the organizational resources that go with it—seems assured of success in the commercial marketplace. □

► parts can be coupled to operate as a single unit. Feeding mechanisms and forms guides are provided for forms from 4.0 to 23.9 inches wide, with a print area in the middle 22.1 inches. Cut forms can vary in length from 3 to 17 inches, depending upon forms alignment options. In addition to the standard location of the platen split providing 9 inches on the left, optional splits are available in 2-inch increments for 5- to 17-inch left-side platen widths.

One or two optional Continuous Forms Feeders (CFF) are used to control the horizontal positioning and vertical advance of fan-fold forms. Continuous (slew) advance occurs at a rate of 30 lines/second, and single-line advances via the line-feed keys or program commands require about 300 milliseconds per line. Up to 15 lines can be continuously advanced through a single command. Each CFF is driven by a pair of pin-feed tractors, although forms without holes can also be accommodated through adjustable pinch rollers as part of the basic forms handler. Among the operator controls and indicators on each CFF are an out-of-paper sensor/tension device and a Vertical Format Unit (VFU). The out-of-paper/tension indicator can be tested under program control, with appropriate operator messages provided as required. The VFU advances forms under control of a 1-inch wide, 8-channel carriage control tape.

The standard numeric keyboard consists of a separate pad of 10 keys, arranged in an industry-standard format. Optionally, the user can specify a full 14-digit keyboard, containing 14 rows of stay-down amount keys (1 through 9). The 10-key and 14-key numeric keyboards can be switched in the field, and each has a 16-digit buffer. On the 10-digit keyboard, digits are entered into the buffer each time a key is depressed, and an audible tone is sounded to

reassure the operator that data entry has taken place. On the 14-digit keyboard, data does not enter the buffer until the Enter bar or a Branch key for an alternate routine is pressed. Other numeric keyboard control keys include the Clear key for error recovery, and the Reverse (R) key for negative value indication.

The alphanumeric keyboard can be used to enter data at up to 24 characters/second; its operation cannot be overlapped with other NCR 399 functions. Alphanumeric control keys provide for serial printer backspacing, forward or reverse positioning, upshifting and downshifting, platen spacing, etc.

SERIAL PRINTER: Uses a glass-reinforced phenolic resin ball-shaped print device, plated with a very hard alloy of chrome-nickel. The replaceable ball has a character set consisting of 64 ASCII characters and 24 special characters. The printer can operate at a rate of 24 characters/second for numeric data and an average of 20 characters/second for alphabetic data. Forward and return ball positioning is provided at a tabulation rate of 12.5 inches/second. The standard horizontal print spacing is 12 characters/inch, with an optional spacing of 10 characters/inch for print lines of 265 or 221 print positions, respectively. The ball print mechanism is similar to those of IBM and Burroughs, but the NCR printing element is not interchangeable with those of either vendor. NCR paper forms for up to 12-part printing are available from the NCR Systemedia Division.

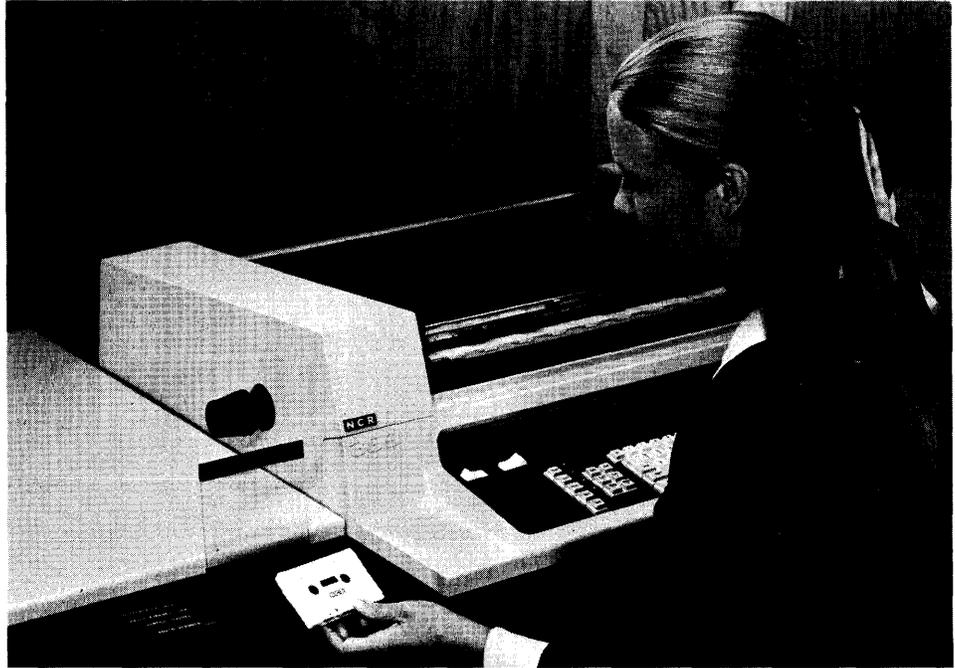
AUTOMATIC LINE FIND PERIPHERAL (ALF): Aligns front-inserted cut forms—conventional as well as magnetic—to a predetermined print line. The first ALF peripheral on an NCR 399 System must be on the right side, and a second optional ALF can be attached on the left. Only the right ALF can handle magnetic-stripe documents. From 4 to 76 print lines can be accessed on conventional or magnetic cut forms for documents from 6 to 16 inches in length, respectively (also depending upon top margin widths from 1 to 3 inches).

MAGNETIC-STRIPE DOCUMENTS: This optional processor capability handles cut forms that are generally used as magnetic ledger cards. These documents store data on a ½-inch wide vertical magnetic stripe on either side of the form, ½-inch from the left edge. Data is also printed on the face of the document, at a vertical spacing of 6 lines per inch and a horizontal spacing of either 10 or 12 characters per inch. Data storage and printing are under program control. The magnetic-stripe documents can be from 6 to 16 inches long and from 6 to 16 inches wide, and can vary in length by 1-inch increments and in width by 1/10 or 1/12-inch increments. The magnetic data storage capacity of the magnetic-stripe cards varies from 156 8-bit bytes per side (312 4-bit numeric digits) to 782 8-bit bytes per side (1564 4-bit numeric digits) for cards from 6 inches to 16 inches long, respectively. An automatic read-after-write check is performed, with vertical magnetic-stripe reading at a rate of 20 inches per second. A variety of console indicator lights notify the operator of the status of the magnetic-stripe document processor.

Other free-standing peripherals promised for the NCR 399 are a line printer, paper tape reader/punch, automatic ledger card reader, and punched card reader/punch. Full specifications will be released later in 1972. No further information is available at this time.

COMMUNICATION CONTROL: Transparent communications adapters are available for either asynchronous or

NCR 399



Magnetic tape cassettes permit programs and data to be loaded into the 399 at the rate of 750 bytes per second. Data can be recorded on the cassette as a byproduct of posting operations. One cassette handler is included in the basic NCR 399 system, and a second handler is optional.

► synchronous communication over voice-grade dial-up or leased lines. Transmission is on a point-to-point basis to other NCR 399 systems or to small competitive processors such as Burroughs TC Series, etc.; or to larger computers in a multistation network, such as the NCR Century Series, IBM System 360/370, etc. The NCR 399 communications adapters handle ASCII or EBCDIC transmission codes in half duplex using 2 or 4 wire facilities at 1800 to 9600 bits/second in synchronous mode and up to 1600 bits/second in asynchronous mode. Line interfacing is through any modem that meets EIA RS 232 interface requirements, such as the Bell System Series 100, 200, etc. Bisynchronous communications disciplines can also be accommodated. The communications adapters, when present, are always given the highest priority in an NCR 399 system.

SOFTWARE

The NCR 399 operates under control of user programs written in NCR 399 Assembler Language. This user language is similar to NEAT/3, Level 1, which is used on the larger NCR Century Computers; it offers 37 macro commands which are translated into machine-language instructions for the 605 Minicomputer that is the heart of the NCR 399. Because the language is common to the NCR Century Series, NCR 399 programs can either be entered through the keyboard on the NCR 399 for direct assembly, or prepared on a larger Century processor and then run on the 399.

An Interpreter provided by NCR on a cassette processes the user's 399 Assembler Language program and fulfills many of the functions otherwise handled by operating systems on larger computers. When the user's source program is entered, a flag is set that lists the assembler macros required. The required macros are then link-loaded from the cassette.

The basic Interpreter containing those support modules considered by NCR to be common to all user programs occupies about 3000 bytes of memory. The common macro commands are those that control typing entries, numeric entries and printout, the basic forms handler, and all add, subtract, and branch operations. When functions or peripherals other than the above are required, additional modules that implement the required functions or peripherals are then added. These modules vary widely in size:

<u>Function/Peripheral</u>	<u>Approx. Bytes</u>
Multiply/Divide (rounded)	350
Move	165
Magnetic Ledger	650
Automatic Line Find (ALF)	80
Cassette	510
Communications:	
Asynchronous	1400*
Synchronous	2400*

*Note that the communications adapter requires additional memory buffer areas; typically from 250 to 1000 bytes of memory. Other peripherals will require support modules plus buffer areas that will range in size from about 100 bytes for the Magnetic Ledger Feeder/Reader to as much as 2000 bytes for the disk.

This approach toward tailoring the Interpreter to include only those modules required to process a given program minimizes memory requirements. A typical magnetic ledger application Interpreter and driver will require about 3800 bytes of resident memory. Interpreting and/or assembling can be done on the minimum 8K system, but require the optional second cassette drive. If the program is developed on a larger Century computer, the second cassette drive is not required in order to execute the user program on the

NCR 399

► NCR 399. NCR will make Century processors with cassette handler attachments available through a worldwide network of about a dozen Regional Service Centers to develop NCR 399 program cassettes for customer use.

Programming service is provided by NCR to tailor a library of commercially-used, field-developed applications programs to meet specific user requirements. Many of these are accounting-type systems using parameters which vary locally, as well as from state to state. The customizing service delivers a ready-to-run application program plus documentation to the user on a turnkey basis. NCR guarantees a negotiated flat-fee charge for individual user programs or systems. (This programming service bears a rather striking resemblance to the Application Programming Service available from IBM for the System/3 Model 6.) Subsequent program alterations will be made by NCR at a cost that will not exceed 25% of the original program development charge. More than 80 user-developed NCR 400 programs have been converted for use on the 399.

UTILITY PROGRAMS: NCR supplies a variety of sort programs, media conversion routines, etc., to supplement the turnkey program development service and the NCR 399 Assembler Language.

PRICING

MINIMUM SYSTEM: Consists of a processor with 8K bytes of memory, the standard cassette handler, alpha and 10-key numeric keyboards, serial printer, and standard forms handler. Monthly rental including maintenance is \$420, with a purchase price of \$14,000 and a monthly maintenance charge (for purchased systems only) of about \$56.

MINIMUM MAGNETIC LEDGER SYSTEM: Consists of a processor with 8K bytes of memory, the standard cassette

handler, alpha and 10-key numeric keyboards, serial printer, magnetic ledger capability, and Automatic Line Find feature. Monthly rental including maintenance is \$605, with a purchase price of \$20,050 and a monthly maintenance charge (for purchased systems only) of about \$73.

TYPICAL MAGNETIC LEDGER SYSTEM: Consists of a processor with 12K bytes of memory, 2 cassette handlers, alpha and 10-key numeric keyboards, serial printer, Continuous Forms Feeder, magnetic ledger capability, Automatic Line Find feature, Rear Eject feature, and synchronous communication interface. Monthly rental including maintenance is \$780, with a purchase price of \$25,950 and a monthly maintenance charge (for purchased systems only) of about \$99.

SUPPORT: NCR Field Engineering is available to NCR 399 users at a basic charge of \$22 per hour. This support is for equipment maintenance not covered under other maintenance agreements (e.g., field modifications). On-site systems engineering assistance is available for non-contract NCR 399 programming support at \$20/hour.

EDUCATION: Full customer training is provided by NCR either on-site or at NCR facilities and is separately priced.

CONTRACT TERMS: The NCR 399 is available on a 1-year lease or for purchase only. Maintenance is included in the lease rates at no additional charge for an 8-hour prime period between 8 AM and Midnight, Monday through Saturday. Periods of maintenance which fall outside these times are charged for at a 15% premium over the basic maintenance rate. A 1-year guarantee is given on all parts and labor (other than standard preventive maintenance) for purchased systems. ■

EQUIPMENT PRICES

		Purchase Price	Annual Maintenance	Rental (1-year lease)*
399-100	Processing Unit with 8,192 bytes of memory, 1 cassette handler, and serial printer.	14,000	675	420
—	Additional Memory Increment; 2,048 bytes	1,100	50	35
—	Additional Cassette Handler (Cassette 2)	1,850	60	50
	Magnetic Ledger Handler, for cut-form magnetic-stripe documents (requires ALF-R)	4,800	115	145
ALF-R	Automatic Line Find feature (right side)	1,250	90	40
—	Full 14-Row Numeric Keyboard	650	0	20
—	Rear Eject feature for cut forms (for right side only; requires ALF-R)	400	30	15
904-7	Continuous Forms Feeder-1 (CFF)	700	45	25
904-8	Continuous Forms Feeder-2 (CFF)	700	35	25
Basic Comm.	Asynchronous or Synchronous Communications Adapter (when ordered initially with 399)	750	75	15
Add-On Comm.	Asynchronous or Synchronous Communications Adapter (when added to 399 as field upgrade)	1,500	75	30

* Rental prices include equipment maintenance.

NOTE: Cassettes are available from the NCR Systemedia Division at \$92 for a carton of 10 cassettes. NCR estimates that a typical 399 user will require about 20 cassettes. Quantity purchase discounts are provided. Contact NCR for further information.